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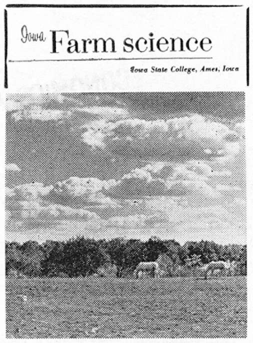
There once was a popular children's traveling game of counting white horses. Possibly conscious of the passing of this game, Harold Stickler, a graduate student in technical journalism, found these in a pasture north of Ames and supplied this month's cover picture.



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ON "FLYING BLIND" . . .

Iowa State College agronomists have long recommended soil tests as a basis for fertilizer applications. Applying fertilizers without a knowledge of soil and crop needs is more or less "flying by the seat of your pants" -- as airplane pilots had to do before the advent of instrument flying. This was fine when the weather was clear and the pilot could see when to do what -- not so fine during fogs and storms or for the inexperienced.

When you make "shotgun" applications of "just some of everything," you may be paying for and applying one or more elements that may not be needed. Worse, you may do this while not applying enough of the element needed most. Though you may happen to "hit the nail on the head," it's more likely that you're short changing yourself somewhere along the line.

Soil test results and interpretations, on the other hand, permit making applications "with your eyes open" and doing this logically according to needs. You can invest your money where it's most needed to give greatest returns.

For most meaningful results, however, soil samples must accurately represent the soil area you want tested. For tips on this, see the article on page 9.

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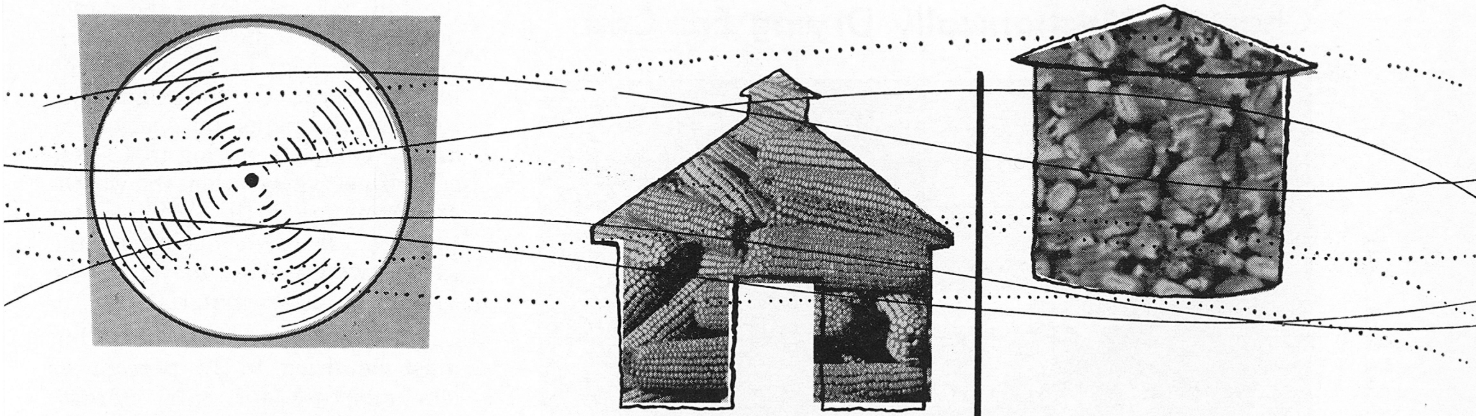

What Does It Cost TO DRY ... CORN?

Returns from artificial drying vary from year to year, depending on weather and other conditions. But it's possible to give a reasonably accurate picture of the costs to consider along with the advantages and disadvantages.

by Bernard A. Everett and Raymond R. Beneke

HOW MUCH does it cost to dry your corn mechanically? The answer depends mainly on the moisture content of your corn, the amount to be dried, the method used and your storage facilities. However, we now have sufficient information available to give you a reasonable guide for the per-bushel costs for drying a given amount of corn.

Four basic methods are available for mechanically drying corn. It may be dried either as ear or shelled corn, and either form may be dried with heated or unheated air.

Possible returns from mechanical drying are equally important in deciding whether to invest in drying equipment. Returns, however, are even more dependent on weather and harvesting conditions than are costs. We can't yet give you an accurate picture of possible dollars-and-cents returns. But we can give you some idea of the sources and types of returns you can expect.

First, let's look at the costs.

What Does It Cost?

Costs on Farms With Storage Already Available

If you already have adequate storage and fit the drying equipment to the structure already available, the estimates of per-bushel costs in charts 1 and 2 fit your situation. Costs for drying ear corn are shown in chart 1; costs for shelled corn in chart 2.

Cost estimates for ear corn are based on a double crib fitted with reinforced paper to keep air from escaping before it passes through the corn. The center driveway serves as the air duct.

Cost estimates for drying shelled corn with unheated air are for drying at a grain depth of 4 feet in any type of bin using a perforated or wire mesh false floor as a duct. If necessary to build a special air duct, such as for an overhead bin, this cost would be additional. Costs for drying shelled corn with heated air are based on use of an 18-foot circular steel bin with a perforated steel false floor. Corn would be dried in this structure and then moved to other storage.

In making these estimates, we charged electricity at 2.6 cents per kilowatt hour, fuel oil at 14.3 cents per gallon and labor at $1.25 per hour. For annual depreciation costs, we charged 10 percent of the initial purchase price for all mechanical equipment, 5 percent for steel buildings and 3 percent for wooden structures. To cover miscellaneous costs such as taxes,

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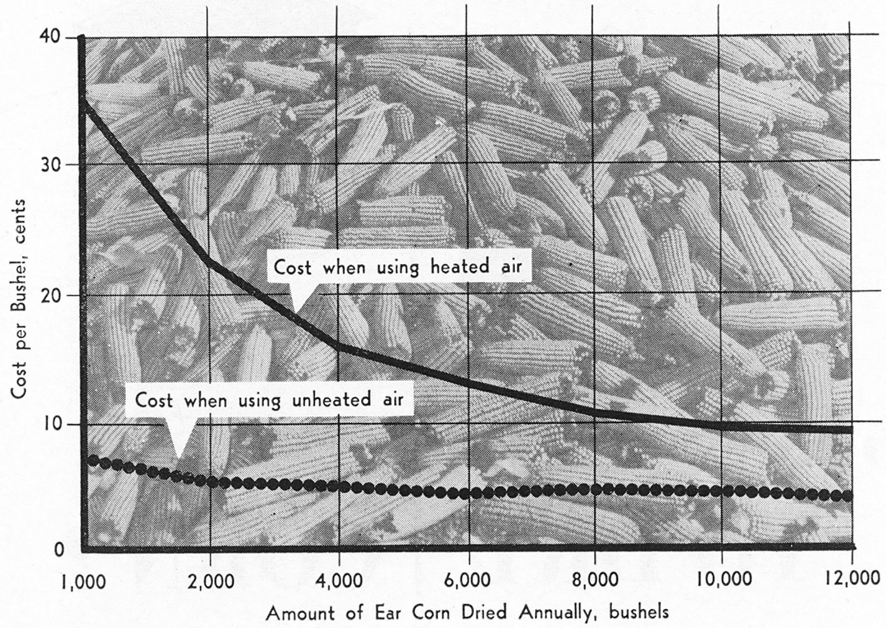
Chart 1 Mechanically Drying Ear Corn



insurance and repairs, we made a yearly charge of 4.5 percent of the initial investment in drying equipment and 3.8 percent for buildings. We charged interest on investment in buildings at 5 percent.

Costs of drying with heated air in both charts 1 and 2 are based on the use of a direct-fired, oil-burning drier.

Operating Costs: Drying time depends on the amount of moisture reduction. Cost estimates in the charts assume an initial moisture content of 25 percent to be reduced to about 13 percent by drying. If you dry with unheated air, the final moisture depends entirely on the weather. If fall weather is humid, drying with unheated air may not dry the corn to 13-percent moisture. So the costs in chart 1 assume that the paper will be removed and thrown away after initial drying with unheated air to permit natural ventilation to bring the corn on down to safe moisture levels.

With good drying weather in the fall, you can leave the paper on and save some of the cost if your corn dries to 13 percent or less moisture. Or you might plan to leave the paper on every year and to complete drying to 13 percent, if necessary, when the weather warms up in the spring. But the cost of extra drying in the spring would tend to offset the savings in cover material cost.

Shelled corn stored in a bin must be dried to 13 percent or less moisture for safe storage. Costs in chart 2 for unheated air assume that, when weather is too moist to dry the corn to 13 percent in the fall, drying will be continued in the spring.

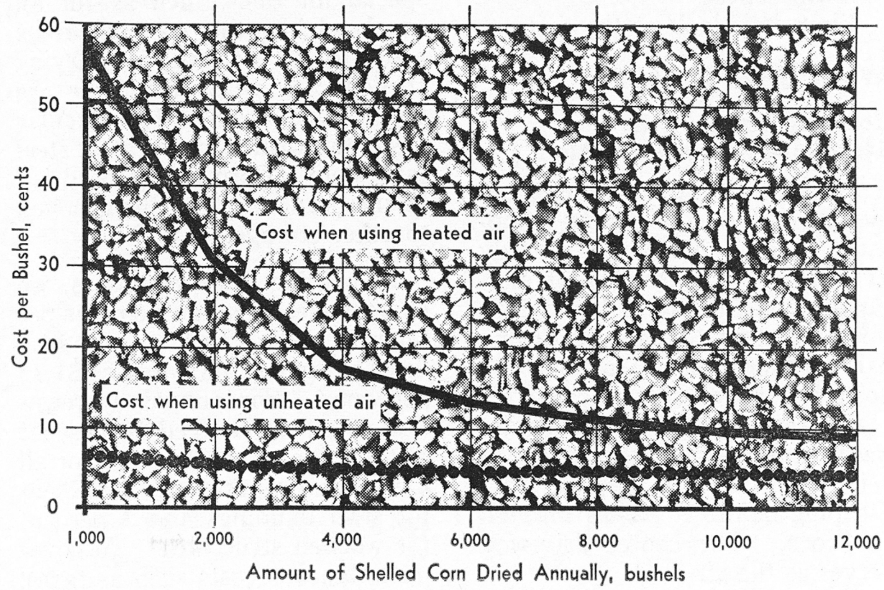
The cost per bushel of drying corn with heated air decreases as the equipment is used to dry a greater volume of corn. The drop is especially sharp up to 4,000 bushels. Beyond this point, per-bushel costs level out.

With unheated air, low-cost operation is much less dependent on a high volume. Since the investment in equipment is lower, fixed costs per bushel aren't great—even though the drying equipment is used on a limited number of bushels each year. The drying time necessary with unheated air usually is too long to permit equipment to be used for more than one batch each year. So increasing the volume of corn dried with unheated air must be done by providing more equipment—rather than drying more bushels with the same facilities as can be done with heated air.

Advantages, Disadvantages: There are several things to bear in mind in comparing these costs. For example, though unheated air generally is less expensive, it's almost completely dependent on the weather. In continuous wet weather, unsatisfactory drying may result in some loss from spoilage.

Cost estimates for drying shelled corn with unheated air assume a 4-foot grain depth. So, to be able to dry your corn at these costs, you must be able to store all the corn you wish to dry at a maximum depth of 4 feet. The power needed to force air through shelled corn increases rapidly at greater depths. And the cost of

Chart 2 Mechanically Drying Shelled Corn



equipment needed goes up rapidly also.

If you can't store your shelled corn at a depth of 4 feet or less, the higher cost of expanding your storage facilities or of obtaining more expensive, high-powered equipment tends to offset the cost advantage of this method. Drying shelled corn with unheated air at a depth of 10 feet, for example, is more expensive than batch drying with heated air when 2,000 bushels or more are to be dried.

Heated-air drying also has the advantage of flexibility. Unheated air driers must be designed to handle a certain quantity of corn. Using them for more than this can often result in unsatisfactory drying. Batch drying is possible with heated air because of the shorter drying time. So any size of heated-air drying system can be used for a wide range of total bushels.

Equipment Costs: If funds are limited, initial cost of the equipment is an important factor. Unheated air has the advantage of lower initial costs, though the use of unheated air is less flexible and more dependent on the weather than heated-air systems.

Drying 6,000 bushels of ear corn with unheated air, for example, requires a 7½-horsepower drier, costing about $780. Drying the same amount with heated air can also be most economically done with a 7½-horsepower drier. But the heated-air drier costs about $2,000. The difference is less at higher levels of corn to be dried. Drying 12,000 bushels of ear corn calls for two 7½-horsepower unheated-air driers, costing $1,560. The single $2,000 unit would still be most economical for heated air.

Costs Where New Storage Must Be Built

Sometimes it's necessary to construct new storage facilities to make provisions for mechanically drying corn. Or you may be planning new storage facilities for ear or shelled corn. How does the cost of drying and storing ear corn compare with drying and storing shelled corn? These cost estimates are shown in chart 3 for drying with heated air. These estimates assume that cribs with narrow center air ducts would be built for ear corn and that a batch drying system would be used for shelled corn, with the shelled corn stored in round steel bins.

Chart 3 Mechanically Drying With Heated Air and Storing Corn

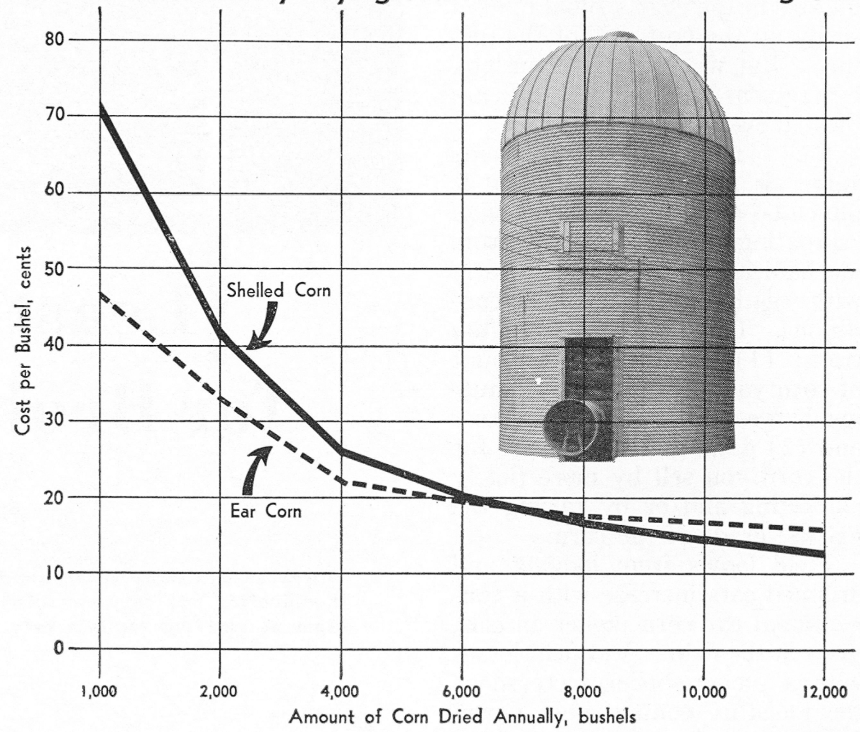


Chart 3 shows the yearly cost per bushel of both *drying* and *storing* corn when new storage must be built especially for drying. Where ear corn storage is especially designed for drying, the cost for drying and storing ear corn is less than for shelled corn up to about 6,000 bushels. If the amount is greater than 6,000 bushels, shelled corn has the cost advantage.

The difference in cost between the two methods isn't great except at low volumes of annual use. The cost savings with larger volume come mainly from spreading the fixed costs of the drier over more bushels rather than from storage alone. With shelled corn, however, the bin equipped to serve as a batch drier results in a small per-bushel economy as more bushels pass through it.

Possible Returns . . .

The important point in deciding whether or not to invest in equipment is whether the returns will

Approximate Costs Per Bushel of Mechanically Drying Corn

	Amount of corn dried annually, bushels						
	1,000	2,000	4,000	6,000	8,000	10,000	12,000
	(cents per bushel)						
Ear corn with unheated air:							
30% initial moisture	8.3	6.2	5.6	4.9	5.2	5.2	4.9
25% initial moisture	7.4	5.4	5.0	4.3	4.6	4.6	4.3
Ear corn with heated air:							
30% initial moisture	39.1	25.0	17.8	14.6	12.9	12.0	11.2
25% initial moisture	36.3	22.2	15.7	12.6	10.8	9.9	9.2
20% initial moisture	33.4	19.3	13.6	10.4	8.6	7.7	7.0
Shelled corn with unheated air:							
25% initial moisture	6.5	5.4	5.2	4.9	4.6	4.8	4.8
20% initial moisture	5.9	5.0	4.9	4.6	4.3	4.4	4.6
Shelled corn with heated air:							
25% initial moisture	57.3	30.7	17.6	13.2	11.0	9.7	8.8
20% initial moisture	55.8	29.4	16.2	11.8	9.6	8.2	7.4

equal or exceed the costs. The estimates in the charts should aid in sizing up the cost side of the picture. But where should you look for returns, and how great are they likely to be?

Putting a dollars-and-cents value on returns from drying is difficult—even more difficult than estimating costs. Benefits from mechanical drying vary greatly with weather and harvesting conditions. The returns come mainly from: (1) increasing the amount of corn you have to sell by reducing harvesting and storage losses and (2) getting a better price for the corn you sell by more timely marketing and/or by raising the market grade of the corn.

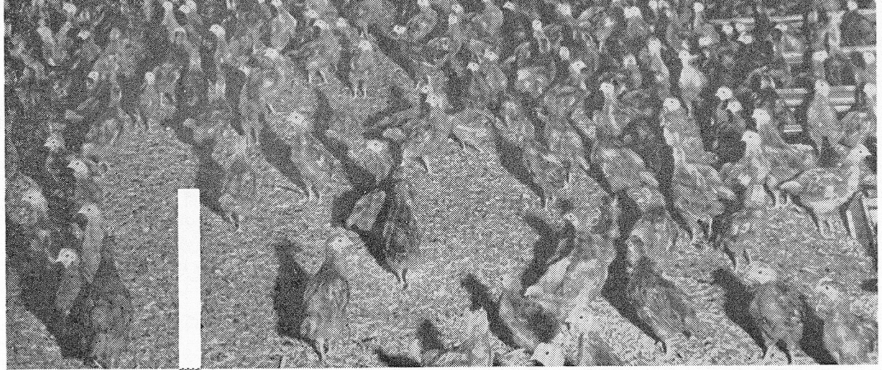
Field losses from lodging and dropped ears increase with a conventional ear corn picker as corn dries in the field. And field losses with a picker-sheller increase as the moisture content goes down. Mechanical drying reduces these losses by making harvest practical at a higher moisture level.

Loss reduction through earlier harvesting may be only 1-2 bushels per acre in normal years. But it may be much greater — 15-20 bushels or more—during extremely dry falls or when heavy corn borer damage has weakened the corn.

Mechanical drying reduces storage losses but little if the corn is fully matured and can be dried thoroughly in the field before harvest. But during wet corn years, mechanical drying is about the only way to make safe storage possible or to avoid heavy price discounts for high moisture.

Mechanical drying also permits a more flexible harvest schedule so that you can plan fall work to use available labor more effectively. Mechanical drying can sometimes help you gain a price advantage by getting your corn to market before the seasonal price decline.

There are other less tangible benefits — such as the security gained from less dependence on the weather with a heated-air drier. Weigh these along with the other types of returns we've listed to get some idea of whether the returns — tangible and intangible —will exceed the estimated costs for the size of operation you have.



Least-Cost Rations for Broilers . . .

Whenever two items substitute for one another in doing the same job, it will often pay to use a little more of one and a little less of the other as costs for the two vary. Take broiler rations, for example . . .

by Stanley Balloun and Earl O. Heady

AN IMPORTANT part of managing any farm enterprise is keeping production practices up to date. This includes keeping the use of your resources in line with changing prices and costs.

Especially when two resources can substitute for each other in producing the same thing, you may need to use a little more of one and a little less of the other as the costs of each change. By doing so, you produce the particular product at lower cost and increase profit possibilities. This principle applies to machinery and labor, different sources of nitrogen fertilizer, different kinds of feed—wherever one will substitute for the other.

We've completed some research with broilers to find out how feeding rations can be changed in line with changes in the costs of feed ingredients. If you have only a small flock of broilers each year, you may buy your feed already mixed and pay little attention to the costs of the ingredients that do or could go into it.

As the size of your broiler flock increases, however, it becomes more important to know what ration gives lowest-cost gains—particularly near the end of the production period. This type of information also is of value to the feed manufacturer interested in producing least-cost rations for broiler producers.

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What's Needed . . .

By far the greatest proportion of a broiler ration consists of grains and protein feeds. These two ingredients make up as much as 1,800 pounds in a ton of broiler-finisher ration. But the other 200 pounds — minerals, vitamins, etc. —are extremely important. These ingredients are needed in rather definite amounts. Without them, no combination of corn and soybean oilmeal alone provides an economical or balanced diet for broilers at any stage of growth.

To make efficient use of the ration, broilers must have these other ingredients in their feed.

The major part of the complete ration consists of corn and soybean oilmeal. And it's possible to use various combinations of the two to produce the same gain. Usually these feeds substitute at a diminishing rate. That is, each additional pound of one tends to replace less and less of the other for each pound of gain.

Starting from a particular combination of the two ingredients in a low-protein ration, for example: Addition of 1 pound of protein feed may replace 3 pounds of corn; addition of another pound of protein feed may replace only 2 pounds of corn. So both the substitution or replacement ratios and the costs of the two ingredients determine the least-cost ration.

Using this same example: If corn costs 2 cents a pound and protein feed costs 5 cents a pound, you'd achieve lower costs by substituting the first added pound of protein feed; the first pound, costing 5 cents, replaces 3 pounds of corn, worth 6 cents. But the second added pound of protein feed, also worth 5 cents, replaces only 2 pounds of corn, worth 4 cents.

What We Did . . .

We used battery-grown broilers in our experiments, with corn and soybean oilmeal as the "substitution" ingredients. But the same principles apply to other carbohydrate and protein feed sources—if the ration is fortified with the proper vitamins, minerals and trace elements.

Table 1 shows the rates of substitution between corn and soybean oilmeal in the rations we used for broilers in two weight intervals — up to 1.3 pounds and from 1.3 to about 3 pounds.

The table indicates several important facts:

● As soybean oilmeal is substituted for corn (increasing the protein content of the ration), increasingly greater amounts of oilmeal are needed to replace a pound of corn. In the light-weight interval, for example, 1 pound of oilmeal replaces 3.35 pounds of corn when the ration contains 16 percent protein. When the ration contains 18 percent protein, 1 pound of oilmeal replaces only 2.26 pounds of corn; and only 1.21 pounds when the ration already contains 22 percent protein.

● The substitution ratio of soybean oilmeal for corn is lower as birds reach heavier weights. With a 16-percent protein ration, 1 pound of oilmeal replaces 3.35 pounds of corn in the lighter weight range but only 2.75 pounds in the heavier range. With an 18-percent protein ration, the replacement rate is 2.26 for the lighter birds, 1.86 for the heavier ones. This simply indicates that broilers need less protein as they grow larger and that the addition of soybean oilmeal doesn't improve the ration as much as for younger birds.

TABLE 1. Combinations and Substitution Rates of Corn and Soybean Oilmeal for Producing a Pound of Gain

Percent protein in ration	Broilers up to 1.3 lbs. liveweight: Lbs. feed to produce 1 lb. of gain — Corn	Soybean oilmeal	Rate of substitution of soybean oilmeal for corn	Broilers from 1.3 to 3.1 lbs. liveweight: Lbs. feed to produce 1 lb. of gain — Corn	Soybean oilmeal	Rate of substitution of soybean oilmeal for corn
16........	1.8	0.4	3.35	2.5	0.5	2.75
17........	1.6	0.4	2.72	2.3	0.6	2.23
18........	1.5	0.5	2.26	2.2	0.7	1.86
19........	1.4	0.5	1.90	2.1	0.8	1.56
20........	1.3	0.6	1.62	2.0	0.8	1.33
21........	1.3	0.6	1.40	1.9	0.9	1.15
22........	1.2	0.7	1.21	1.8	1.0	0.99
23........	1.1	0.7	1.05	1.7	1.2	0.87
24........	1.1	0.8	0.92	1.7	1.3	0.76
25........	1.0	0.9	0.81	1.6	1.4	0.66
26........	0.9	0.9	0.71	1.5	1.5	0.58

Least-Cost Ration . . .

The least-cost ration is found by relating the price ratio—price of soybean oilmeal divided by that of corn—to the substitution ratio. If corn is 2.5 cents a pound and soybean oilmeal 4 cents, the price ratio is 4 divided by 2.5, or 1.6. Finding the nearest rate of substitution to 1.6 in table 1, we find a 20-percent protein ration gives lowest costs per pound of gain for broilers up to 1.3 pounds. For larger birds, a 19-percent protein ration gives least-cost gains.

As the cost of soybean oilmeal comes down in relation to the cost of corn, it becomes more profitable to feed more protein. If soybean oilmeal were $60 a ton (3 cents a pound) and corn $1.35 a bushel (2.41 cents a pound), the soybean oilmeal-corn ratio would be 1.24. At this price ratio (ta-

TABLE 2. Feed Requirements Per Broiler and Time Needed to Attain Specified Weights When Fed Various Protein Rations

Percent protein in ration	Starting to 1.3 lbs. weight: Pounds feed	Appr. no. days	Starting to 3.25 lbs. weight: Pounds feed	Appr. no. days
16.0......	3.11	45	9.82	83
16.5......	3.00	44	9.55	81
17.0......	2.96	43	9.41	80
17.5......	2.91	43	9.36	79
18.0......	2.86	43	9.29	79
18.5......	2.83	42	9.22	78
19.0......	2.79	42	9.17	78
19.5......	2.77	41	9.14	77
20.0......	2.74	41	9.11	77
20.5......	2.72	41	9.10	77
21.0......	2.71	41	9.09	77
21.5......	2.70	41	9.10	77
22.0......	2.69	40	9.11	77
22.5......	2.68	40	9.14	77
23.0......	2.68	40	9.18	77
23.5......	2.68	40	9.22	78
24.0......	2.68	40	9.28	78
24.5......	2.70	41	9.36	79
25.0......	2.70	41	9.44	79
25.5......	2.71	41	9.52	80
26.0......	2.74	41	9.62	81

ble 1), a 22-percent protein ration would be the least-cost ration up to 1.3-pound broiler weights; about a 20-percent protein ration would give least costs from 1.3 pounds to market weight—assuming in each instance that each ration is fed throughout each weight interval.

Our research didn't include experiments in which the protein levels were changed within the weight intervals. But, in a practical situation, a broiler producer could be expected to lower costs still further by lowering the protein content of the ration at a broiler weight of about 2½ pounds.

The chart provides a simplified method of finding the least-cost ration. The single-ration column of figures shows the least-cost ration if the same one is fed over the entire production period. The interval-ration columns show the least-cost rations for each of the two weight intervals.

Here's how the chart can be used: Say the price of soybean oilmeal is \$4 per cwt., or 4 cents a pound, while corn is \$1.40 per bushel, or \$2.50 per cwt. Follow across the horizontal "\$4 line" for oilmeal until it crosses the "\$2.50 line" for corn. Then follow the diagonal line nearest this point to find the least-cost ration. If a single ration is fed throughout, the least-cost ration would include 19-19.5 percent protein. If the ration is to be changed at about 1.3 pounds broiler weight, the ration for the light interval would include 20-20.5 percent protein; for the heavy interval, it would include 17.5 percent protein.

Most Profit?

Broiler nutrition research usually has emphasized fast gains—with the thought that fastest gains are the cheapest gains. While this is often true, it's not necessarily always true—especially if the fastest gains must be achieved by using a large proportion of a relatively high-priced ingredient.

Broilers fed a relatively low protein ration generally take longer to reach market weight than those fed rations higher in protein. So a producer must balance the gain of feeding a least-cost ration against the possible gain of getting his broilers on the market before a price break—or against the possible gain from speeding up the production process and having more broods per year with his limited labor and housing space.

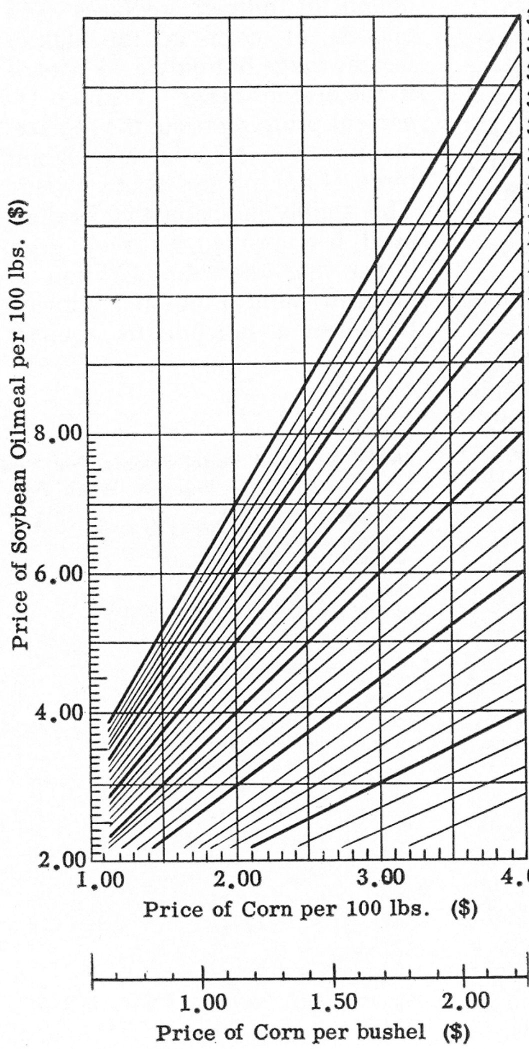
The information in table 2 shows the total pounds of feed and total time required to produce market weight with rations containing different proportions of protein. The time needed to reach a given weight declines at first as the percentage of protein is increased. Later, this time trend reverses itself as relatively large amounts of protein are used.

Likewise, the total pounds of feed needed behaves the same way as protein content is increased. But remember that the ration requiring the smallest total poundage isn't necessarily the one with lowest feed cost. This depends on the relative prices of the two major ingredients.

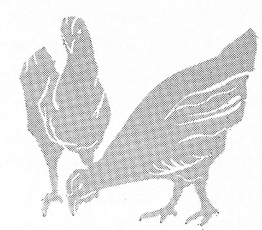
For You . . .

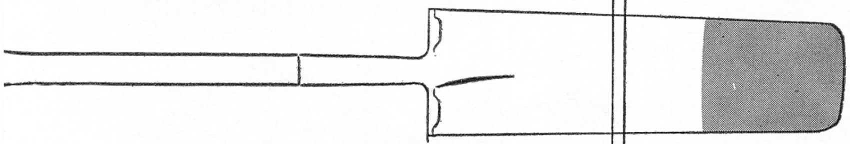
This information will likely be of most use to producers with enough volume to justify changing the broiler ration during the production period. If your flock is small and you buy your feed ready-mixed for the entire feeding period, the single-ration column in the chart may be helpful as well as the general principles and information in the tables. It may be that feed manufacturers will eventually make specific "least-cost" and "least-time" broiler feeds available.

Simplified Method of Determining Least-Cost Broiler Ration

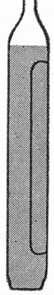


SBOM-corn price ratio (in 100 lbs.)	Least-cost single ration	Least-cost interval rations 1st to 1.3 lbs.	Least-cost interval rations 2nd 1.3 lbs. to mkt. wt.
3.5–3.4	15.0	16.0	—
3.4–3.3	15.5	16.0	—
3.3–3.2	15.5	16.0	—
3.2–3.1	15.5	16.5	—
3.1–3.0	15.5	16.5	—
3.0–2.9	16.0	16.5	—
2.9–2.8	16.0	17.0	—
2.8–2.7	16.0	17.0	15.0
2.7–2.6	16.5	17.0	15.0
2.6–2.5	16.5	17.5	15.5
2.5–2.4	16.5	17.5	15.5
2.4–2.3	17.0	18.0	15.5
2.3–2.2	17.0	18.0	16.0
2.2–2.1	17.5	18.5	16.0
2.1–2.0	17.5	18.5	16.0
2.0–1.9	18.0	19.0	16.5
1.9–1.8	18.5	19.0	16.5
1.8–1.7	19.0	19.5	17.0
1.7–1.6	19.0	20.0	17.5
1.6–1.5	19.5	20.5	17.5
1.5–1.4	20.0	20.5	18.0
1.4–1.3	20.5	21.0	18.5
1.3–1.2	21.0	22.0	19.0
1.2–1.1	21.5	22.5	19.5
1.1–1.0	22.0	23.0	20.0
1.0–0.9	23.0	24.0	20.5
0.9–0.8	23.5	24.5	21.5
0.8–0.7	24.5	25.5	22.5





How to Take a Soil Sample



by William F. Bennett

There's nothing complicated about sampling your soil for a soil test. The important thing is that the sample accurately represent the soil of the area being sampled. Here are some guides for getting best results.

SOIL TESTS have proven their value in determining limestone and fertilizer needs for soils. But the results and conclusions from them can be no better than the samples on which the tests are made. Results from tests made on poorly taken samples may actually be misleading—besides being a waste of time and money.

There's nothing complicated about taking a soil sample. It's quite simple. The important thing to remember is that the sample you take should accurately represent the soil of the area being sampled.

Assuming you intend to use the results of a soil test, it's only common sense that the samples you take should be properly collected for the results to be of most value to you. Here are the "how's" and "why's" of the recommended method to take a soil sample.

Sample Uniform Areas

Each sample you submit for testing should represent a uniform area of soil. Soil differences important in sampling are indicated by differences in drainage, slope, color, texture and degree of erosion. Consider also differences in yields, crop growth, crop history and in past treatments such as liming, manuring and fertilizing.

For example, crops grow better on a soil that's well drained than on one that's poorly drained. So don't mix samples from a well-drained soil with those from a poorly drained soil. Also, soils on the slope differ from those on the flat upland. Sample them separately.

With these factors in mind, size up the area you intend to sample before you begin sampling. In general, a uniform area of soil will seldom be larger than 5 to 10 acres. So limit the size of the area for one sample to less than 10 acres.

Get Good Sample

Take 15 to 20 samples in each uniform area. These are subsamples and, when thoroughly mixed, will give a composite sample representative of the fertility status of the whole area.

Take the subsamples or "cores"

WILLIAM F. BENNETT is an associate in agronomy and is affiliated with the Iowa State College Soil Testing Laboratory.

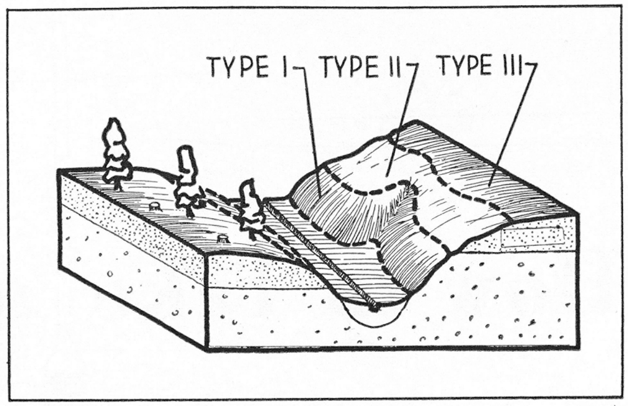
Brief Soil Sampling Guide

- Each sample submitted should represent a uniform soil area—usually from 5 to 10 acres in size.
- Sample 15 to 20 locations in each uniform area to obtain a composite sample which will accurately represent the area being sampled. Take samples from the plow layer—about 6 inches deep.
- Use a soil probe, a soil auger or a garden spade to take samples.
- Don't take subsamples from areas that are unusual or different from the rest of the area being sampled. Should you want a separate soil test for such an area, sample this area separately and don't mix it with other samples.
- Mix the subsamples from one uniform area thoroughly. Place a portion of the mixed composite sample in a soil sample box and send it to the Iowa State College Soil Testing Laboratory at Ames or Cedar Rapids.
- Be sure to send a completed soil sampling information sheet along with the samples.
- Allow about 4 to 6 weeks for conditioning and testing the samples and for return of the results.

at random over the area — being careful to avoid unusual spots in the field. Don't follow the rows in taking subsamples; you may have added extra fertilizer in previous years on those particular rows. Zig-zag across the field in taking samples. In corn fields, take the samples from between the rows.

For each subsample you take, scrape away the surface litter and take a sample from the plow-layer —about 6 inches deep. Subsoil samples aren't necessary. Soil Testing Laboratory personnel know in general how the subsoil samples will test for most areas in the state.

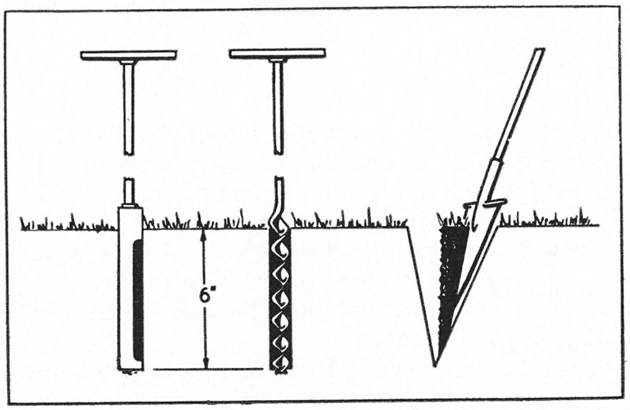
Each sample should represent a uniform soil area—usually 5 to 10 acres in size.



Avoid Unusual Areas

Avoid unusual areas such as dead furrows, back furrows, old fencelines, eroded spots, old haystack bottoms, field depressions and terraces when taking subsamples. These areas aren't representative of the field and shouldn't be included in the main sample.

If there's an unusual area, such as a small sandy area in a field, don't take any subsamples from it unless you intend to fertilize it differently. If you plan to do this, take a separate sample for this area but don't mix it with the ones from surrounding areas.



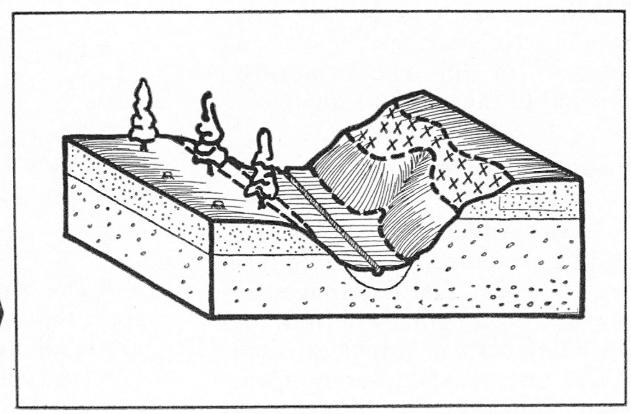
Use a probe, auger or spade to take samples to a depth of about 6 inches.

Sampling Tools . . .

A number of tools can be used to take soil samples. The handiest tools are a soil probe or a soil auger. A soil probe works best when the soil isn't too wet or too dry. Your county extension director can tell you where you can get these tools.

If you have neither of these, you can take soil samples with a garden spade. Dig a V-shaped hole. Then take a 1-inch slice of soil from the smooth side of the hole. Discard a portion of the slice from both sides of the spade. Put the remaining soil in the container as one subsample.

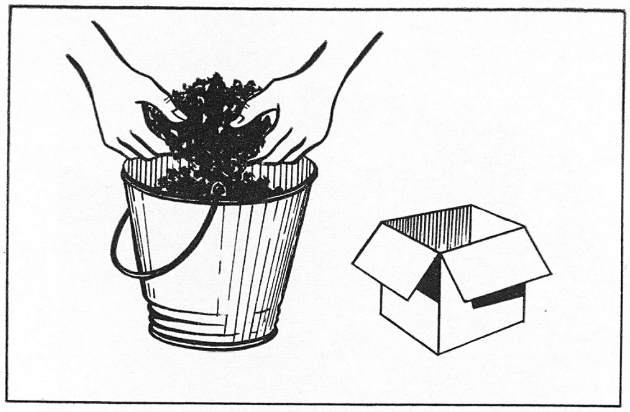
Sample 15 - 20 locations in each uniform area; avoid dead and back furrows, old fencelines, etc.



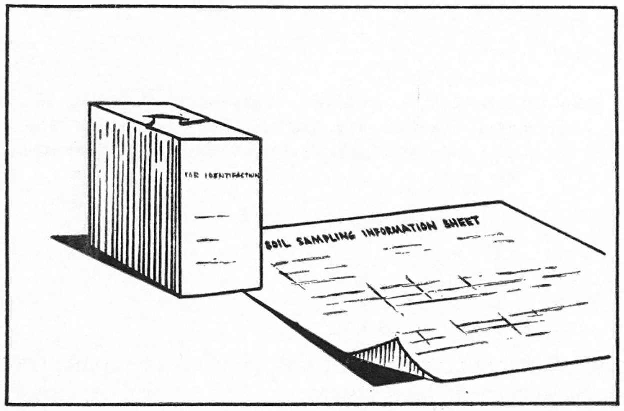
If you plan regular soil sampling and testing, you may prefer to make a soil auger. Take an old 1-inch wood bit. Cut off the center bite screw and sharpen the cutting edges. Weld the bit onto a ⅜-inch pipe or steel rod about 36 inches long. Add a "T" joint to the top of the pipe or rod and add short lengths of pipe for a handle.

Use Clean Container

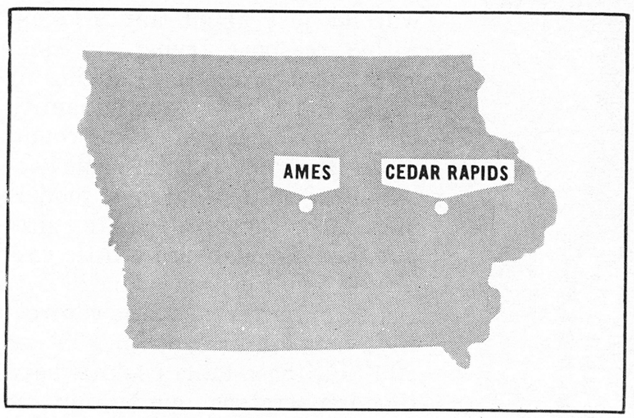
Mix the 15 to 20 subsamples together in a *clean* container for a



Mix subsamples thoroughly in clean container and fill soil sample carton.



Be sure to complete soil information sheet and to send it in with sample.



Package securely and send to Iowa State College Soil Testing Laboratory at Cedar Rapids or Ames.

representative composite sample. Containers such as buckets and paper sacks are satisfactory. But be sure they're large enough so that the sample can be well mixed.

After mixing, take out enough of the composite sample to fill a soil sample box. Be sure to mark the sample number on the container as soon as the sample is taken. Allow the sample to air dry at room temperature; a gentle breeze from a fan blowing over the sample can be used to hasten drying. *Don't use heat* to dry the sample; this will lead to inaccurate soil test results.

Complete Information Sheet

Mailing cartons, information sheets and soil sample boxes may be obtained from your county extension office, the county ASC office, the county SCS office, your school's vocational agriculture instructor or from your fertilizer dealer.

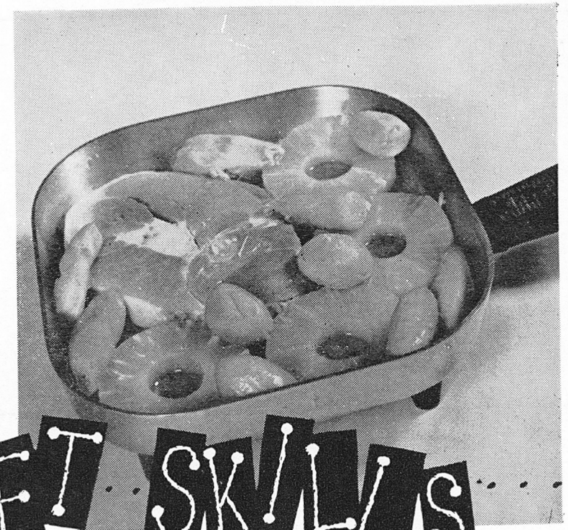
Obtain a soil sampling information sheet from one of these sources. Fill it out completely and submit it with the sample. This sheet gives the Soil Testing Laboratory information on where the sample came from, the physical condition of the soil (such as slope and drainage) and past treatment (such as cropping history, manuring and fertilizing). This information is important when it comes to making the most meaningful and useful fertilizer recommendations.

There's a place on this sheet to draw a map—showing the location of the sample areas with respect to farm buildings, drainage ways and other areas. This map can be drawn while dividing the field for sampling. The map will often be useful in interpreting the results of the test. Be sure to keep a copy of the map for yourself as a record of where the samples were taken.

Allow Time . . .

Allow about 4 to 5 weeks after the samples reach the Soil Testing Laboratory for the samples to be tested and the recommendations made. During the fall and winter months, allow an additional week or two because of the large number of samples submitted during these months.

This length of time is needed for the conditioning and accurate testing of a sample. So take your samples well enough in advance of planting so that the results can be returned in time to be useful.



look to your SKILLET SKILLS

Skillet cookery is making a comeback. Leading the way are the new automatic electric fry pans. Don't overlook the good old top-of-the-range skillet cookery either, though temperature is often critical.

by Jewel Graham

COOK IT RIGHT at the table with an automatic electric fry pan. Or try your skillet skills at the range. The newer ranges feature thermostatically controlled surface units or burners which are "made to order" for this kind of cookery.

But even if you don't have a new range with thermostatic controls, or an automatic electric fry pan, you can still do wonderful skillet cookery. The secret is to use a heavy skillet, a well-fitted lid and to tone down the flame or electric unit so you have lower temperature—slow cookery.

Several reasons have prompted a renewal of interest in skillet cookery: the trend toward easier living — easy-to-prepare meals — and the fact that families like to cook on-the-spot. That's where the automatic fry pan comes in handy, indoors or out. The new ranges also simplify skillet cookery and, *with care,* there isn't a skillet recipe for the electric fry pan that you can't prepare in a skillet on your own range.

It used to be that a skillet meant just fried foods. But this is no longer true. The automatic fry pan proves how versatile a skillet can be. With its built-in heat controls, and usually a cooking guide on or near the handle, it has taken the guesswork out of surface cooking — much as oven controls have assured successful baking.

Main asset of the automatic electric fry pan is that it takes the guesswork out of surface cooking. The temperature control maintains whatever cooking heat you may select.

Table fry pans on the market will do just about any cooking within reason — frying, braising, stewing, thawing and cooking of frozen foods; even small-quantity baking. Some models are round in design, some square, some rectangular. Square design models offer more capacity for area size, but round models are a little easier to clean.

Featuring thermostatic controls with temperatures up to 400° or 500° F., these table cookers have time-temperature guides on or near the handle. Some models have sealed elements so they can be immersed for washing. The control handles for some are detachable. Others may be immersed to a point on or near the handle, but the handle is not detachable. A few may not be immersed but can be washed out in-

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JEWEL GRAHAM is assistant professor of food and nutrition.

side with warm water and mild suds and then rinsed and dried. How you wash your fry pan will depend on the placement of the control device. Follow the instructions carefully to insure long service of your fry pan.

All models need a 110-120 volt AC electrical outlet. For maximum efficiency and safety, be sure you connect the fry pan directly into a wall or range outlet. Plan to store this appliance in a handy place in your kitchen so you can use it often. But don't store it in your oven—the *handle and controls* can be affected by oven heat. Neither is there a need to put it in the oven to "keep things warm" —the fry pan itself is much more economical for this purpose than the oven.

Correct Temperature

Controlled temperature surface cookery is the big feature of the automatics. This asset makes possible the wide range of cooking—from frying to stewing to baking. Most established brands of automatic electric fry pans on the market have accompanying recipe books which give specific directions for the many types of cooking possible. Temperatures recommended for such cookery may be followed for ordinary skillet cookery on your range provided that the heating units are thermostatically controlled or that you yourself can control the heat fairly closely.

Frying is a case in point. One of the most important points in correct frying is to have the fat hot enough so that the food doesn't absorb too much fat. The trick is to have the fat hot enough but not so hot that it smokes. The automatic fry pan lets you know by a signal device (small light) just when the fat is heated to the desired degree; it then maintains that heat throughout the cooking period. When the food is fried or cooked as desired, set the heat control at "off" position or at a very low point to keep food warm.

Try These Meals

Here are some appetizing and economical recipes which may tempt you to put your old-fashioned skillet back into use again, or to keep that new automatic fry pan busy. Remember, though, that temperature control is often critical — a "touchy" business without the benefit of automatic control.

Creamy A La King

(Leftovers creamed in soup)

A little leftover chicken or lamb or pork, a few odds and ends of peas, potatoes, asparagus, plus a can of cream of celery or mushroom or chicken soup make a good meal. Cook and blend gently in a skillet until hot.

Serve over crisp slices of toast or hot buttered biscuits.

Brown Beef Stew

Serves 4

1 lb. boneless stewing beef	1½ cups water
1 tsp. salt	3 potatoes, diced
¼ tsp. black pepper	2 onions, sliced
2 to 3 tbsp. flour	3 carrots, diced
2 tbsp. fat	1 cup raw snap beans (or canned)

Method:

1. Cut meat in 1-inch cubes.
2. Sprinkle with salt, pepper and roll in flour.
3. Brown in fat with skillet set at 360° F. (or medium temperature).
4. Add water, cover and simmer until almost tender at 220° F.
5. Add vegetables, season with salt and pepper and continue to simmer, covered, until vegetables are done. Stir occasionally.

Serve with coleslaw or green salad with peaches and cake for dessert.

Minute-Steak Stew

Serves 4

4 minute or cube steaks (about 1 lb.)	2 tbsp. finely chopped onion
1 tsp. salt	½ cup vegetable liquid
¼ tsp. pepper	1 cup cooked peas and carrots
⅛ tsp. paprika	6-8 small cooked potatoes or 3-4 large ones cut
2 tbsp. flour	1 can tomato sauce
2 tbsp. butter	

Method:

1. Cut the steaks into 1-inch strips; season flour with salt, pepper and paprika. Roll strips in seasoned flour.
2. Heat butter in skillet at 360° F., add meat and brown well on both sides.
3. Stir in remaining ingredients, cover skillet and simmer 10 minutes at 220° F.

Serve hot with hard rolls and a fruit dessert.

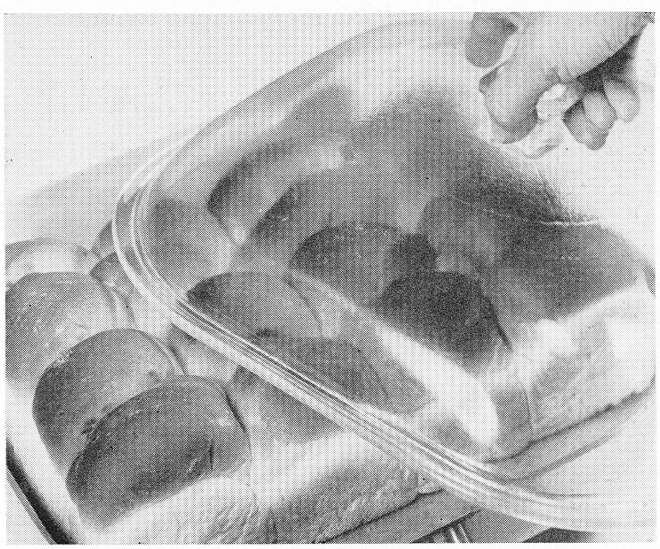
Ham with Pineapple and Yams

Serves 4 (depending on size of ham)

1 slice precooked or tenderized ham (½- to ¾-inch thick)	4 pineapple slices (or thick apple rings)
1 tbsp. shortening	1 can sweet potatoes or 4 medium cooked sweet potatoes

Method:

1. Preheat skillet at 330° F. Melt shortening.
2. Cook ham and pineapple slices 8 to 10 minutes



LEFT: You can heat fresh or frozen rolls in a covered electric fry pan when it's set in the warm temperature range; you can even do some types of baking. RIGHT: You can successfully prepare favorite recipes such as barbecued meat balls and noodles in an automatic fry pan—or with an ordinary heavy skillet on your range. Use a well-fitted lid and tone down temperature for slow cookery.

on one side, depending on thickness, turning pineapple as it browns.
3. Turn ham and arrange pineapple slices on top of meat.
4. Add yams and brown while ham cooks on second side.

Serve immediately with buttered broccoli, cranberry orange salad, rolls, ice cream and cookies.

Braised Short Ribs with Vegetables
Serves 4

3 lbs. short ribs cut in individual servings
1 tbsp. salt
½ tsp. pepper
Flour for dredging
1 medium size onion, sliced
1 cup chopped celery and leaves
¼ cup minced parsley
1½ cups water
8 small onions
8 small carrots
4 medium size potatoes

Method:
1. Trim off excess fat, and melt enough of fat trimming for fat to brown meat.
2. Sprinkle meat with salt and pepper and roll in flour.
3. Brown carefully on all sides at 360° F. in hot fat.
4. Cover meat with sliced onion, celery and parsley.
5. Pour water down side of pan, cover and bring to boiling point.
6. Reduce heat and simmer (200° F.) until meat is almost tender.
7. Add prepared vegetables and cook until vegetables are tender.
8. Remove meat and vegetables to hot platter and make gravy. (Remove excess fat if necessary.)

Add enough meat coloring (Kitchen Bouquet) to give a rich, brown color.

Barbecued Meat Balls
Serves 6

1½ lbs. ground beef
¾ cup rolled oats
1 tbsp. minced onion
1½ tsp. salt
¼ tsp. pepper
1 cup milk
Flour to dredge balls
3 tbsp. fat

Method:
1. Combine meat, oats, onion, salt, pepper and milk.
2. Form into small balls (about 18).
3. Roll in flour and brown in fat in a heavy skillet or an electric fry pan set at 360° F.
4. Cover with a barbecue sauce.

Sauce:
2 tbsp. sugar
2 tbsp. Worcestershire sauce
1 cup catsup
½ cup water
¼ cup vinegar
½ cup minced onion

5. Combine sauce ingredients and pour over browned meat balls.
6. Turn heat low—200° to 220° F.—and simmer until done, and sauce is fairly thick.

Serve hot with rice or noodles or with hot cornbread, a tossed salad, fruit and cookies.

Veal Scallopini
Serves 4

4 tbsp. flour
1½ tsp. salt
¼ tsp. pepper
1 lb. thin veal steak (4 small)
4 tbsp. fat (butter preferred)
2 peeled cloves garlic
1 8-oz. can tomato sauce
½ tsp. dried oregano
1 tsp. monosodium glutamate (Accent)
2 tbsp. packaged onion soup mix
½ cup water
2 tbsp. grated Parmesan cheese

Method:
1. Combine flour, salt and pepper; use to coat veal.
2. Melt fat in skillet set at 360° F. to brown veal with garlic. Remove veal and discard garlic.
3. Into fat left in skillet, stir tomato sauce, oregano, monosodium glutamate, onion soup mix and water. Simmer 5 minutes.
4. Return veal to sauce and cook, covered for 30 minutes at 200-220° F. Add a little more water if it gets too thick.
5. Serve hot, sprinkled with grated cheese.

Complete the meal with buttered carrots and cabbage wedges, bread sticks and prune whip.

Scotch Meat Patties
Serves 4

¾ lb. ground beef
⅓ cup milk
¾ cup quick-cooking oats
1 tsp. salt
¼ tsp. pepper
2 tbsp. cooking fat
1 cup water
¼ cup chopped celery
¼ cup chopped green pepper
¼ cup chopped onion
1 tsp. Worcestershire sauce
1 tbsp. flour

Method:
1. Combine meat, milk, oats, salt and pepper. Make very thin patties.
2. Brown on both sides in hot fat with skillet set at 360° F.
3. Add water and vegetables, season with Worcestershire sauce, ½ tsp. salt and pepper.
4. Cook over low heat—200° F.—covered for 30 minutes.
5. Blend flour with a little cold water. Add slowly to the mixture and cook until thickened, stirring occasionally.

Serve with apple and cabbage salad and fruit and cookies for dessert.

Macaroni Supper
Serves 4

2 tbsp. butter or margarine
1 cup elbow macaroni
2 cups tomato juice
½ lb. cooked beef cubed (or raw ground beef)
1 medium onion, chopped
1 tsp. salt
½ tsp. pepper
1 cup cheese, cubed

Method:
1. Melt butter or margarine in fry pan, set at 300° F. or low moderate heat.
2. Add macaroni and stir to coat thoroughly with fat.
3. Add tomato juice and bring to rapid boil.
4. Stir in beef, salt and pepper, cover, reduce heat to 250° F. and cook 15 to 20 minutes.
5. Remove cover. Stir and sprinkle cheese over top. Remove from heat, cover and let cheese melt.

Finish this "one-dish" meal with raw vegetable or fruit salad.

Dinner in a Skillet
Serves 4

4 veal or lamb shoulder chops
1 tsp. salt
¼ tsp. pepper
¼ cup fat
1 clove garlic
1 cup water
1 bouillon cube
4 or 5 small onions
6 or 8 pared carrots cut in chunks
4 pared small potatoes halved or large ones quartered

Method:
1. Sprinkle chops on both sides with salt and pepper.
2. Heat fat with garlic in skillet set at 360° F.
3. Add chops and brown on both sides, remove garlic.
4. Add water with bouillon cube dissolved.
5. Simmer, covered (220° F.) about 30 minutes.
6. Arrange onions, carrots and potatoes around chops, sprinkle vegetables lightly with salt and pepper.
7. Simmer, covered, until all are tender.

Serve from skillet with tossed green salad, melba toast and orange tapioca cream.

Sausage and Corn Omelet
Serves 4

1 lb. pork sausage
1 12- to 16-oz. can whole kernel corn
1 tsp. salt
⅛ tsp. black pepper
4 eggs
½ cup milk

Method:
1. Make small sausage patties (about 8).
2. Place on cold frying pan set at 300° F. or over medium low heat.
3. Cover and cook until brown on one side. Turn and finish browning.
4. Remove from frying pan. Pour off all but 5 tbsp. fat.
5. Add well-drained corn, season and heat thoroughly.
6. Add eggs, beaten with the milk.
7. Cook until eggs are set, stirring and turning to cook evenly.
8. Turn onto platter or chop plate and arrange sausage around the omelet.
9. Serve at once.

Complete the meal with a vegetable salad and fruit dessert.

Ground Beef and Hominy
Serves 4

1 tbsp. fat
½ cup chopped onion
½ cup chopped green or red pepper
1 lb. ground beef
1½ tsp. salt
1 cup tomatoes
2 cups (No. 2 can) hominy
1 cup grated cheese

Method:
1. Melt fat in heavy skillet over moderate heat or in electric fry pan set at 360° F.
2. Add chopped onion and pepper and cook slightly.
3. Add ground beef, break it up so it covers the surface of the skillet and cook until partly browned.
4. Add tomatoes, drained hominy and salt.
5. Cover and cook, at 220° F., until meat is done and most of the liquid has evaporated.
6. Remove from heat and sprinkle grated cheese over the top of the meat mixture.
7. Cover and let cheese melt. Serve hot from skillet.

To complete the meal, serve a molded fruit salad, ice cream and oatmeal cookies.

Meat and Hominy Skillet Meal
Serves 6

1½ lbs. meat
2 to 3 tbsp. flour
1½ tsp. salt
⅛ tsp. pepper
3 tbsp. fat
1 medium onion, sliced
2 cups water
1 No. 2 or 2½ can hominy

Method:
1. Cut meat (pork, ham, veal) into 1-inch cubes.
2. Dredge in flour seasoned with salt and pepper.
3. Heat fat in frying pan, and brown meat on all sides. Keep heat low. Electric fry pan set at 360° F.
4. Add onion and water and simmer over low heat until meat is tender. If water evaporates, add more to give a medium thin gravy.
5. Add drained hominy. Cover and continue cooking until hominy is heated thoroughly. Serve hot.

To complete the meal, serve tossed vegetable salad, lemon sponge and milk.

Sea Food Mornay
Serves 6-8

6 tbsp. butter
4 tbsp. flour
½ tsp. salt
⅛ tsp. black pepper
1½ tsp. Worcestershire sauce
3 cups milk
½ lb. Swiss cheese (cubed)
1 12-ounce package frozen shrimp, cooked
1 6-ounce can lobster meat
1 6½-ounce can crabmeat

Method:
1. Melt butter in skillet set at 360° F.
2. Stir in flour, salt, pepper and Worcestershire sauce.
3. Add milk and continue to cook, stirring constantly, until mixture is slightly thickened.
4. Add cheese, stir until melted.
5. Add sea food, blend into mixture.
6. Garnish with a border of toast hearts or baking powder biscuits or serve over fluffy rice.

Add assorted relishes and a fruit dessert.

Skillet Supper
(Leftovers sauteed in soup)

What's left in the refrigerator? The remains of a roast? A chunk of steak? Some string beans or a few other vegetables? It's time for a skillet supper.

Cut up the meat, add the vegetables, blend in a can of tomato soup. Heat in a skillet, and you have a hearty main dish that looks good, tastes good and saves on the grocery bill.

Serve over split hot or toasted corn bread or crisp toast.

YOUR EXPERIMENT STATION REPORTS . . .

Agricultural Engineering

Continuous Ventilation Helps Prevent Spoilage In Stored Grain

CONTINUOUS VENTILATION with air flow as low as 50 cubic feet per minute has been effective in controlling moisture migration and spoilage in farm-stored corn and soybeans.

Iowa State College agricultural engineers studied on-farm grain storage conditions in Story County for the 1954-55 winter season. Fifty bins of grain were included in the study. Of these, 30 were of 1953 shelled corn, 11 were of 1954 soybeans and 9 were of 1954 oats. Most of the grain was under seal or purchase agreement with the CCC. Construction materials included wood, steel and masonry block. Capacities ranged from 560 to 9,000 bushels.

Thermocouples were installed in the bins for determining temperatures, and moisture conditions were obtained by sampling. Mechanical ventilation was installed in 10 of the bins. Continuous air flows as low as 50 cubic feet per minute provided by 80-watt electric fans effectively controlled moisture migration.

W. V. Hukill and Floyd L. Herum supervised the study.

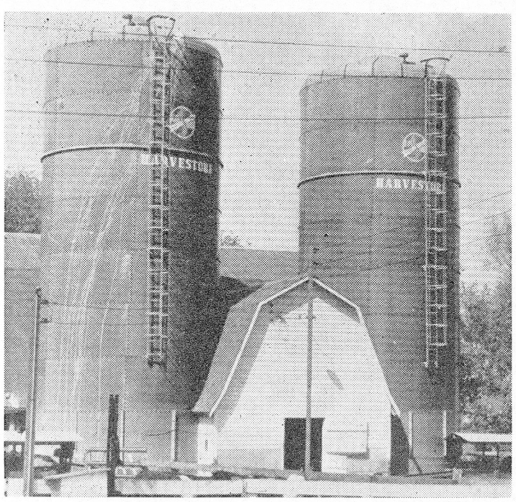
Intensify Study of Mechanizing Chore Labor

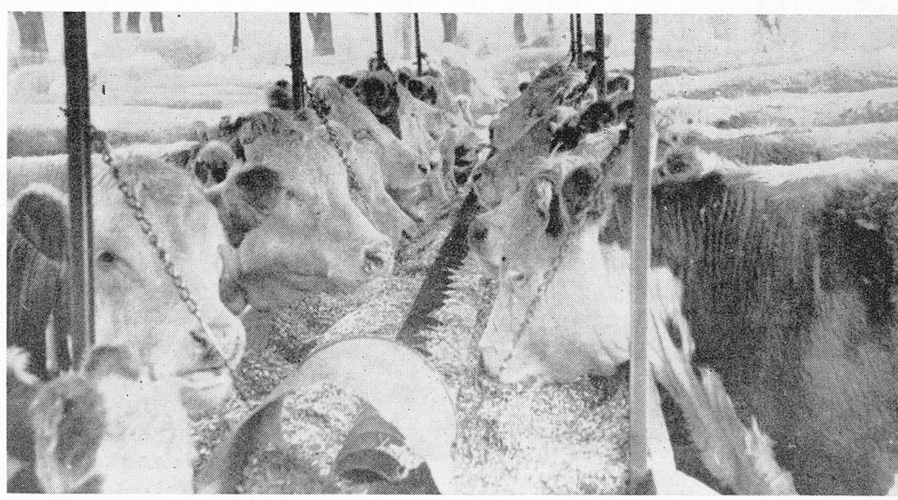
AGRICULTURAL ENGINEERS at Iowa State College have intensified their study of chore labor mechanization. Farms for study were recommended by county extension directors, animal husbandry specialists and electric power suppliers. Fifty beef and swine farms were visited.

Methods of material handling and feeding are of primary interest. A motion picture of the mechanical feeding operations was made on seven of the more mechanized farms as an aid and record for future study. David L. Calderwood and Landy B. Altman have been in charge of the study.

Test Flail-Type Forage Harvester Performance

THE LUNDELL forage harvester is typical of one of several implements that have appeared in the farm implement trade as a possible answer to the need for a lower cost forage harvesting machine—but one which will produce a grass product comparable to that provided by conventional forage harvesters. The machines perform operations differently than do conventional forage harvesters.





Agricultural engineers are looking into possible ways to save chore labor. LEFT: Silos store corn and silage. Other items to be included in the rations are added automatically from storage bins. The rations are then delivered to a feeding bunk by an auger. RIGHT: A close-up view showing how an auger riding in channel irons can be used to distribute final ration in a cattle-feeding bunk.

Cooperating power suppliers installed the demand meters and sent in records for analysis in determining the characteristics of farm electrical loads. Aim is to provide better voltage, fewer interruptions.

C. W. Bockhop, A. M. Cowan, Jr., and K. K. Barnes of the Experiment Station have studied the performance of this new type of machine and the product produced by it. On the basis of the results, here are their conclusions:

The kind of flail-type forage harvester which uses a blower to deliver the chopped forage to the wagon generally requires a 3- to 4-plow tractor as a power unit. Power requirements at normal operating capacities are relatively high as compared with conventional harvesters.

Another type of flail forage harvester throws material directly into a wagon and can be used with a 2- to 3-plow tractor for low capacities. This type has a power requirement comparable to that of conventional harvesters at normal and low operating capacities and well below average at high rates of speed.

Both types are versatile farm machines. They can be used as light brush cutters, weed cutters, beet toppers and for other uses than as ensilage harvesters. They may be particularly desirable for green feeding.

Silage made from grass harvested with standard-model flail-type harvesters has been compared with that harvested with conventional harvesters. There have been no differences in legume-grass silage stored in bunkers with respect to carotene, protein, acidity or dry matter. Silage harvested with conventional machines was of shorter cut. There is some evidence of cattle preference for the shorter cut when the final product was self-fed from a bunker silo.

Examine Characteristics Of Electrical Farm Loads

A STUDY concerned with finding out how much electrical energy is used at one time by farms having different combinations of electrical equipment has been conducted in cooperation with the USDA.

Information obtained will help power suppliers to size transformers and service to the load being served. Users should benefit from better voltage and fewer power interruptions. Other benefits may come through improved recommendations on farm wiring problems. Landy B. Altman is in charge of this study.

Test Backfills for Tile Trenches

A TILE BACKFILL experiment has been started at the Ankeny Field Station to measure the durability and effectiveness of various types of backfill for tile trenches.

Types of backfill that have been installed include ordinary soil, corncobs, graded sand and graded backfill made up of layers of tile bats, large to small stones and crushed limestone. The purpose of these porous backfill materials is to improve the removal of surface water from tiled drains. Outflow measurements from the tile lines will give an indication of the effectiveness of the backfills over the years, report David B. Palmer and G. O. Schwab of the Experiment Station.

Previous Crop Affects Corn Yield Response With Irrigation

CORN following soybeans showed less increased yield resulting from two irrigations (totaling 4½ inches) than corn following corn in an irrigation experiment on the Ray Shoemaker farm in Marion County.

Greater depletion of moisture by the previous corn crop as compared with soybeans is believed to be a partial cause, report G. O. Schwab, Paul Nixon and John Pesek of the Experiment Station. The average increase due to irrigation on land previously in soybeans was 6 bushels per acre. These increases were observed where the nitrogen application was 80 or more pounds per acre.

Actual yields of all irrigated plots were about the same. The yield differences compared are those between irrigated and non-irrigated plots.

Study Costs of Field Operations

AGRICULTURAL ENGINEERS made detailed time studies of many field operations during the summer of 1955. They recorded total field time, duration and nature of all times losses, fuel consumption and oil consumption and compared the theoretical capacities of machines with their actual operating capacities.

The results show that large amounts of field time can be wasted by poor management of field operations. The results are also pointing up opportunities for cutting costs of field operations by planning for efficient use of field time. Some of the results were reported and discussed in more detail in the April 1956 issue of Iowa Farm Science. K. K. Barnes and Ray E. Armstrong have been directing this work.

Irrigation, Fertilizers Increase Crop Yields

Yields of corn were increased by irrigation or by combinations of irrigation and fertilizer in tests conducted by Iowa State College agricultural engineers and agronomists in 1955.

Corn yields on sandy soil at the Southeastern Iowa Experimental Farm were increased an average of about 70 bushels per acre with 11 inches of irrigation water. Highest yields on unirrigated plots were obtained with populations of 13,000 to 17,000 plants per acre and with a nitrogen application of 80 pounds per acre. Higher rates of nitrogen on the unirrigated plots did not increase yields. On some of the plots, only one irrigation — applied at silking time — gave only a slight increase in yield. Both nitrogen and irrigation hastened silking time, but nitrogen was more effective than irrigation.

Plots receiving a total of 11 inches of irrigation water throughout the season produced highest yields with 160 pounds of nitrogen per acre. Top yields on these plots were 110 bushels per acre.

On the full-season irrigation plots, high stands up to 23,000 plants per acre did not increase corn yield to any extent. Paul Nixon and W. D. Shrader point out, however, there usually is a marked yield increase in more favorable seasons with higher planting rates. Thus, they say, high corn stands seem desirable, as the cost for the extra seed is small and since high stands may result in a considerable yield increase but are not likely to decrease yields.

A similar irrigation study was conducted on heavier soil near Ankeny in 1955. The best irrigated corn yields were 28 bushels higher per acre than the best unirrigated plots. For similar treatments, the average increase for irrigation alone was 40 bushels, while the average increase for nitrogen alone was 6 bushels. Highest yields on the irrigated plots were 115 bushels per acre. The effects of stands were similar to those found in southeastern Iowa.

Can Estimate Water Yield For Irrigation Reservoirs

Studies have shown that the water flow into reservoirs in southern Iowa may be predicted on the basis of five factors. These are (1) climatic conditions, such as rainfall and evaporation; (2) land use; (3) slope of land in the watershed; (4) type of soil; and (5) land management and conservation practices in the area.

Using these factors, agricultural engineers estimated the water yield from watersheds at Albia, Centerville, Creston, Greenfield and Iowa City and compared the estimates with actual runoffs. The estimates were accurate within 10-15 percent of the measured runoff.

The studies also indicated that it's desirable to have a large reservoir in comparison to the watershed area. Then, in wet years, some stored water will be carried over in case the following year has low rainfall. Using a watershed area as small as is practical reduces the amount of sedimentation and increases the useful life of the reservoir. Design data have been developed from which minimum water yield for periods of 1, 2, 3 and 4 years can be estimated. These studies are being supervised by Paul Nixon, G. O. Schwab and W. D. Shrader.

Obtain Information on Concrete Slab Brooders

Farm requests for information on concrete slab brooders have prompted a study of this method of brooding by the Experiment Station.

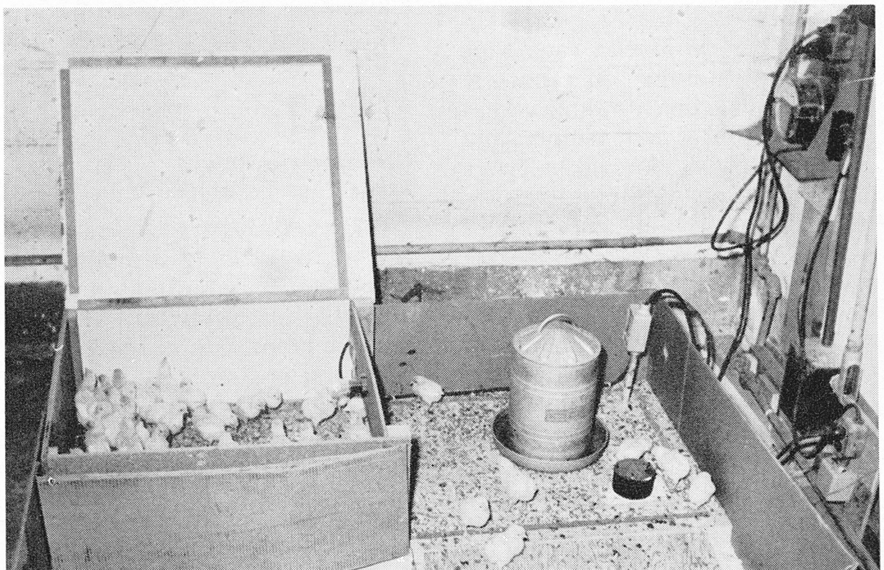
A heating cable was imbedded in a concrete slab to provide 40 watts per square foot of surface. A hover was suspended over half the surface to find if there is any advantage in a hover or baffle for conserving heat. Temperatures were measured at various points on and above the surface. In late March, 50 chicks were brooded on the slab. Further study is needed before definite recommendations may be made. David L. Calderwood conducted this phase of the study.

Hog House Covering May Influence Growth

Summer temperature control for growing hogs in closed shelters may be important in pork production, reports Thamon E. Hazen of the Iowa Agricultural Experiment Station.

Agricultural engineers and swine nutritionists tested the effects of three covering materials on hog shelters of otherwise identi-

Interest in concrete slab brooders has prompted a study of this method of brooding by the Experiment Station. The cover has been lifted back in this photo to show chicks. Recommendations await further study.



cal shape and construction. The covering materials tested were those most commonly used in Iowa—embossed aluminum, galvanized steel and wood car siding with an asphalt shingle roof. All houses were equipped with automatic feeding and watering equipment to provide hogs with uniform free-choice rations and water temperatures.

During one experiment, Hazen says, pigs kept in aluminum-covered houses during an 8-week period in the summer of 1955 gained an average of 0.2 pound more per day on 0.18 pound less feed per pound of gain than pigs housed in galvanized steel-covered houses. Over the 8-week period, this amounted to 11.2 more pounds of gain on 17.1 less pounds of feed for pigs in the aluminum-covered shelters.

There were also differences in rates of gain and feed efficiency between aluminum- and wood-covered houses and between wood- and steel-covered houses. These differences, however, were not considered large enough to be meaningful without further testing.

Nine hog houses were used in the experiment. Each house had four pens measuring 8 by 8 feet, with separate watering and feeding equipment in each pen. The 72 pigs used were of similar heredity and growth characteristics. They averaged 110 pounds each at the start of the test and were carried to an average weight of 205 pounds over the 8-week period. Pigs were allotted to the nine houses randomly, with eight pigs per house. All were managed as nearly alike as possible.

Weight and feed consumption data were recorded at 2-week intervals. One unit with each type of covering was chosen randomly to house instruments which kept continuous records of temperature and humidity. "Spot checks" were also made on the temperatures and humidities in the other houses.

All houses came to about the same temperatures at night, Hazen reports. But daytime temperatures were appreciably lower in the aluminum-covered units and tended to increase feed efficiency by stimulating appetites.

Hazen emphasizes, however, that these results are for only one 8-week period and that further testing under different conditions and with different construction design may show greater or lesser differences. He points out, for example, that a similar test in the winter showed no meaningful differences in rate of gain or feed efficiency and that results also may vary with different summer conditions. Additional testing is in progress.

Seek Efficient One-Man Corn Harvest Operation

EXPERIMENTS attempting to develop and test an efficient one-man system of harvesting, drying and storing corn are underway at the Iowa Agricultural Experiment Station.

To get an idea of the practices in use on Iowa farms today, privately owned farms in the vicinity of Ames were surveyed. The survey showed that systems of handling corn varied considerably from farm to farm, but in general, the operation was quite well mechanized. Operations involved include picking, transporting, shelling, drying and elevating.

In all cases two men were required to keep the harvesting and drying operations going continuously. The survey has shown that harvesting, handling and drying equipment is available which may be combined into an efficient two-man operation. But none of the present systems that have been developed offer a truly efficient one-man operation.

K. K. Barnes, R. R. Yoerger, Ray Beneke, N. H. Curry, Hobart Beresford, W. V. Hukill and C. C. Culbertson are among the personnel working on this project. The USDA is cooperating in this study.

Use Electric Power From Your Tractor?

TRACTOR-MOUNTED electric generators capable of supplying 3-phase, 60-cycle current are now available commercially. This has opened a new area of study in agricultural engineering.

Besides many possible uses for stand-by electric power and for powering hand tools, such generators have a potential to replace or supplement conventional power-takeoff (PTO) transmission for field machines.

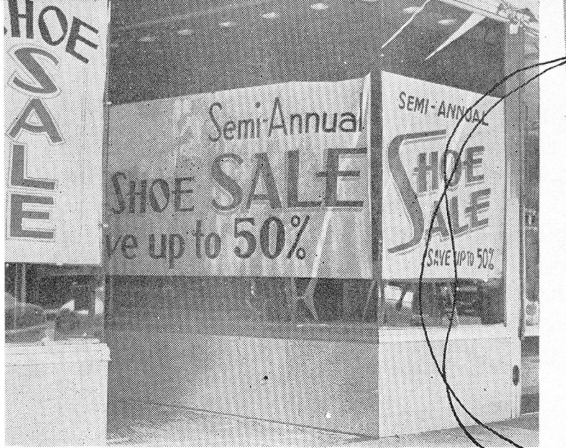
J. H. Anderson and K. K. Barnes of the Experiment Station are investigating the application of electric motors to the various drives of a pull-type combine. They've measured the load characteristics of the individual drives of the combine and have selected motors for the various drives on the basis of the measured loads. The combine will be operated to compare electric power with PTO power from the standpoint of efficiency, convenience and cost.

Tractor-Mounted Implements Becoming More Popular

REAR-MOUNTED tillage implements are becoming increasingly popular. Part of the popularity is based on improved performance of small tractors with mounted implements rather than pull-type implements.

K. K. Barnes and F. W. Bigsby are attempting to evaluate the benefits from mounted implements. They are studying, for example, the forces transmitted to a tractor by a plow mounted on a 3-point implement hitch. Electrical resistance strain gauges placed on the drag links, hanger links and top link enable measurement of forces in these links under field conditions. The forces can then be interpreted to determine the effective weight on the rear wheels of the tractor under plowing conditions.

This photo shows the equipment used for studying field strains in the mounting linkages of a plow in a technical study of the possible benefits of tractor-mounted implements.



When's The Best Time to BUY?

by Phyllis Alvord Presler

Wise buying at sales can mean a net saving on the items you buy. Unwise sale buying may net you nothing. Sound seasonal and sale buying involves looking at the transaction from the standpoint of both buyer and seller.

KEEP AN EYE on the market. It can save you money—if you know *when* and *how* to take advantage of seasonal or special sale buying. Here are the reasons why products may be priced lower at some times of the year than others:

- Seasonal supply is greater than at other times.
- Product is perishable and must move quickly.
- Storage facilities aren't sufficient, and product must move.
- Fashion cycle is changing.
- Old stocks of appliances, home furnishings or clothing must be moved to make room for new merchandise.
- Shift between seasons.

There are other reasons which vary locally. The stimulation sale (anniversary, weekend, dollar-day, pre-season) occurs when business is slow. It may be storewide, or only a limited number of items may be featured. The clearance sale may make way for new styles in clothing, new models or styles in home furnishing or equipment lines. Month-end, post-season, liquidation, seasonal clearance sales and sales of shopworn or damaged goods come in this class.

Wise seasonal and sale buying involves looking at the transaction from both your viewpoint and the seller's:

You want (a) good merchandise at a reasonable price and (b) merchandise which meets a need; there's no point in buying something for which you don't have a need or aren't certain that you'll have a need.

The retailer desires to (a) have you buy more goods than you might otherwise purchase; (b) move shopworn, out-of-date, discontinued, broken-lot or slow-moving merchandise; (c) stimulate buying during a slack season; (d) attract new customers; (e) introduce new goods or (f) develop good will.

Goods offered on sale usually come in two main categories—merchandise regularly carried in stock and special-purchase items. Regular merchandise usually is sold in clearance or "overstocked" sales or in broken-lot or broken-size sales and in sales of goods going out of style. Special-purchase merchandise usually is brought in for anniversary, dollar-day, sample-goods sales, etc. Regularly stocked goods may be offered for sale because they've been in stock for some time, have deteriorated in quality, have been used for demonstration or display or because they're fashion goods moving out of style. Special-purchase merchandise may be "seconds," "irregulars," defective in some way or discontinued or overstocked goods from a supplier. Or the merchandise may simply be goods not quite up to the store's usual standards.

Watch that Price: Prices of goods on sale vary considerably. They may have been marked up before the sale to appear to have been reduced. Or they may actually be marked up, be the same price or genuinely less than the regular price. A careful shopper who knows the regular stock and prices can do a better job of recognizing a saving than one who doesn't. The general trend is that clearance sales offer the largest savings; special-purchase, next largest; and annual or stimulation sales, the least.

PHYLLIS ALVORD PRESLER is an associate in home management.

FOOD BUYING CALENDAR*

Frozen Foods

Corn, Aug., Sept.
Cherries, June, July
Grapefruit juice, Jan., Feb., Mar.
Orange juice, Jan., Feb., Mar.
Strawberries, June, July, Aug.

Fresh Fruits

Apples, Oct., Nov., Dec.
Bananas, Jan., Feb., Mar., Apr., May
Grapes, Aug., Sept.
Grapefruit, Feb., Mar.
Oranges, Jan., Feb., Mar.
Peaches, Aug.
Strawberries, May, June
Watermelon, July, Aug.

Fresh Vegetables

Asparagus, May, June
Cabbage, Sept., Oct., Nov.
Carrots, Feb., Mar., Apr.
Celery, Sept. through Apr.
Green beans, Aug., Sept.
Green onions, Sept., Oct., Nov., Dec.
Lettuce, Feb., Mar., Apr.
Potatoes, Oct., Nov., Dec.
Tomatoes, Aug., Sept., Oct.

Meat

Beef (higher grade), May, June, July
Beef (lower grade), Oct., Nov.
Fryers, hens, turkeys, May through Oct.
Lamb, Oct., Nov., Dec.
Pork, Nov. through Apr.

*These are the times when these foods generally are in good supply and prices are relatively low.

Your Approach: Whenever you buy, but particularly for sales, take your time to decide. For foods, begin with a flexible buying plan so you can substitute low-cost foods in good supply for higher-cost foods in shorter supply. Plan to use more of some foods when supply is largest and cost is down; less when supply is short and cost up. Buy for home canning or freezing when prices are down.

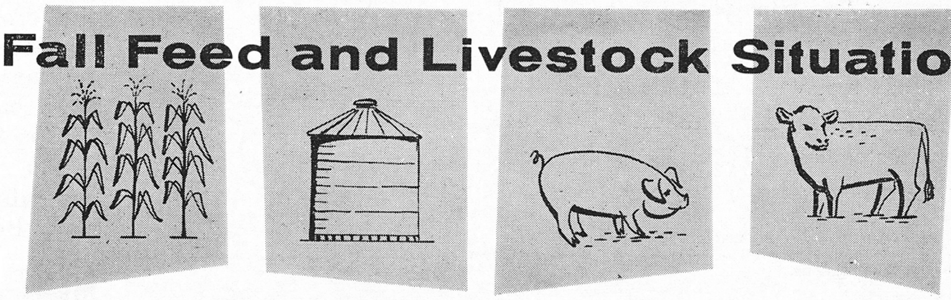
For clothing, home furnishings and appliances, consider: What was the original price? Is this a bargain? If it needs cleaning or repair, at what cost? Is the purchase necessary? Does it fit in with things you already have? Why was it marked down? Is it worth the price?

Consider the general trend in prices. If the trend is downward, sale buying may not be wise. If upward, savings may be substantial.

Kind of sale	Time of year	Sale goods	Savings
CLOTHING			
Inventory (Clearance)	Late December January July	Fall and winter coats, suits, dresses, casual and sports wear	As much as 50%; average around 25%
Seasonal (Clearance)	Before and after Christmas Before and after Easter After July 4	Coats Suits Dresses Casual and sportswear Shoes	Average 25%; may save up to 50%
End-of-the-month (Clearance)	Last of month, but not every month	Soiled items or stock that has been in store for some time	Average 25%; but up to 50%
Stimulation	August January	Fur trimmed coats Lingerie Night clothes	10-15% on regular stock 15-20% on special purchase
Odd sizes (Clearance)	August	Dresses Coats Shoes	Average 25%; as much as 50%
Dollar days (Stimulation and/or special purchase)	Summer	Most items in stock, but may not include large ones like coats, suits and dresses	10-15% on regular stock 15-20% on special purchase
HOME FURNISHINGS			
White goods	January July	Bedding Towels Linens	Vary
Furniture	February August	Pieces that have been on display, a little soiled	As much as 50%
		Discontinued lines	Vary
		Furniture in warehouse to make room for new merchandise	10%; sometimes as much as 25%
Curtain and drapery fabrics	At various times during the year	Fabrics purchased for special sellings	Usually 10% to 20%; sometimes more
		Soiled goods Discontinued patterns	Sometimes marked down several times before sold—read tag. 10% to 15%
Floor coverings	Not definite	Discontinued coverings Samples Remnants	Vary
EQUIPMENT			
Clearance or End-of-month	Last of month—limited number of items	Electric housewares, lamps and small appliances	5-10%
Seasonal Inventory reduction	December, November Fall, spring	Mixers—high styled appliances	Often none; sometimes an extra accessory
Obsolete styles Damaged or repossessed	August, February, April Any time	Anything in household equipment	20-30% on obsolete styles Questionable for damaged or repossessed appliances
Special purchase	Slack seasons: unpredictable, dependent on weather and business conditions	Ranges, refrigerators, freezers, air conditioners, fans, irons, washers, dryers	10-15% on regular stock 15-20% on unknown or unlabeled brand goods
Stimulation: Out of season	Usually winter, but may be at other times	Power lawn mowers, air conditioners, dehumidifiers, for example	15-20%
Future delivery	Unpredictable slack seasons	Ranges, refrigerators, water heaters	10-20%; may be none if purchased with borrowed money requiring interest payments
Auctions	No specific time Dependent on close-out sales	All household equipment items	10-40%; must know style and price comparisons. Also consider transportation and installation costs
Warehouse Held at locations outside of established business districts; often special purchases of manufacturers' surpluses	Weekends, nights and holidays	Major household equipment	Questionable—dependent on demand. Transportation and service charges might add 10-15% to standard price
Discount house	All year	All household equipment	Frequent markup is 10% over wholesale; major savings are on "fair-traded" items. Merchandise sales final; no returns. Buyer pays transportation, installation and service charges
Trade-in	All year	Refrigerators, ranges, freezers, water heaters, etc.	$10-$100—depending on dealer's overhead expenses, style, original cost of sale item, resale value and demand for the trade-in

Farm Outlook . . .

Fall Feed and Livestock Situation



DEMAND for farm products during the spring was supported in part by a steady rise in consumers' income. Between April and June, consumer incomes, after taxes, rose about 1½ percent.

Consumers have been using their larger incomes to purchase increasing amounts of services and nondurable goods. Spending for durable goods lagged in these months.

Economic activity during the spring months rose substantially. Total output of all goods and services in the country increased about 5 billion dollars from the winter level. However, a considerable part of this advance was due to higher prices.

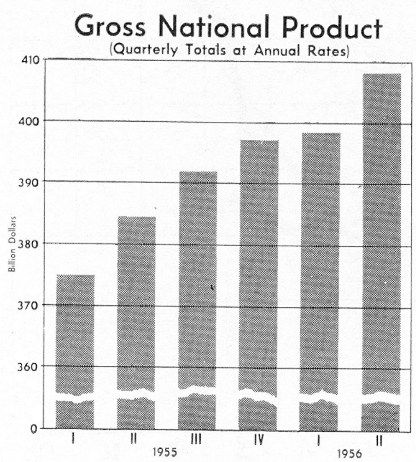
Business kept up its spending pace for new factories and factory equipment. Residential construction did not make its usual seasonal rise during the spring months, however. And sales of durable goods — refrigerators, washing machines, automobiles, and the like—lagged. There was some further build-up in inventory. But the rise was no greater than during the winter months.

Employment in June reached a new high of 66½ million people. That's a million more than a month earlier. It's up 2½ million from a year ago. Unemployment was up also in June, however, for the civilian labor force increased by a larger amount than did employment.

The farm export market has been good. Five markets—Japan, the United Kingdom, Canada, the Netherlands and West Germany — took nearly half of the total United States agricultural exports last year. The value of farm exports for the year ending June 30, 1956, was about 10 percent greater than the previous year. Exports are expected to continue large during the coming year, with cotton in particular showing an increase over the levels of the earlier year.

Retail prices, meanwhile, rose to an all-time high in late spring. Farm prices rose during late spring and summer. Both livestock and grain prices strengthened as summer approached. Prices received by farmers in July were 10 percent higher than the low level of last December.

On a national basis, net farm income in the first half of 1956 was about the same as in the first half of 1955. But larger supplies were offset by lower prices. Expenses were about the same as in the first half of 1955. Prices paid for feed, seed and livestock averaged considerably lower than a year earlier. But this, too, was offset by higher costs in property taxes, wage rates and interest payments as well as by higher prices for some manufactured items.



Feed . . .

Another big supply of feed grains and other concentrates is in prospect for the coming year. Production of feed grains based on July conditions was estimated at about 124 million tons. This would be about 7 million tons below last year's big crop. But another new carryover this fall will swell the total supply. This fall's carryover of feed grains will be about 5 million tons larger than the record 39 million tons of last year.

Thus, once again we've failed to use all our feed production—adding it to the carryover.

During the coming year, a reduction in livestock numbers is in prospect. There won't be as many hogs to feed as during the past year. Other livestock numbers will be about the same. So, based on midsummer weather conditions, feed supply per animal (including CCC stocks) is expected to be slightly larger than that of a year ago. Our feed supply probably will be enough to meet all the livestock requirements for the coming year and leave a still larger carryover for next fall.

Looking at the feed situation more closely, the corn crop was estimated in July to be slightly larger than last year's output.

U. S. Feed Concentrate Balance—1955-56
(Year beginning October)

	1955 Million Tons	1956[1] Million Tons
Supply:		
Stocks beginning of year	39.0	44.0
Production of feed grains	131.2	124.1
Imports of feed grains plus wheat and rye fed	3.3	3.4
By-product feeds fed	23.4	23.5
Total supply	196.9	195.0
Use:		
Total concentrates fed	131.3	129.0
Total use	151.7	149.0
Stocks at end of crop year	45.2	46.0

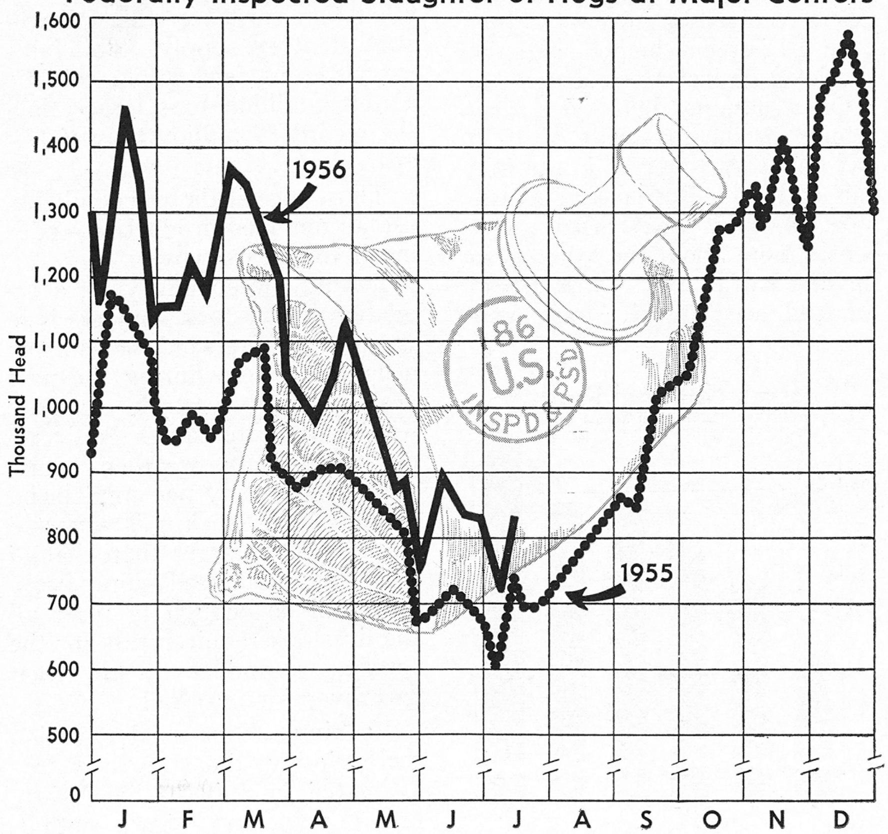
[1]Based on July 1 indications.

This would leave a record carryover of close to 1.2 billion bushels in prospect next fall. However, a relatively large share of this carryover will be in the hands of the government. So the amount of "free grain" carried over will be relatively small. The supply of oats will be substantially smaller than last year; the barley supply moderately smaller.

Feed prices generally have been below those of a year earlier during most of the feeding season. In June the average price paid by farmers for feed grains was within 1 percent of the level a year ago. During July market prices of grains strengthened; the price of soybean oilmeal and some of the other high-protein feeds declined.

Higher support prices for oats and barley and the smaller 1956 crops have pushed up prices of these grains. Prospects are for a large soybean crop. So prices of protein feeds should average lower during the coming year.

Federally Inspected Slaughter of Hogs at Major Centers



Corn prospects, in general, were good in the eastern Corn Belt in midsummer. The situation in the western Corn Belt was varied. There are areas in which prospects were very poor—mainly localized areas in Iowa. In other parts of the western Corn Belt, the crop outcome hinged upon continued timely rainfall. Most of southern Minnesota and northern Iowa had adequate moisture and prospects were good in this area.

The hay crop, however, was generally short over the western Corn Belt.

Meat . . .

Total production of meat this year probably will be large enough to provide about 162 pounds of meat per person. That's a pound more than last year. Beef consumption is headed for the fourth new record in a row. The average civilian will consume around 83 pounds of beef this year. That's 2 pounds more than last year. Pork consumption, on the other hand, probably will drop about a pound down to 65 pounds per person.

The drop in pork supplies will take place during the latter part of 1956 when the effects of the smaller spring pig crop will show up.

Hogs . . .

The 1956 spring pig crop was estimated at about 8 percent below the number raised in the spring of 1955. However, early spring farrowings were larger than a year ago. The main reduction was in late spring farrowings—especially in the western Corn Belt.

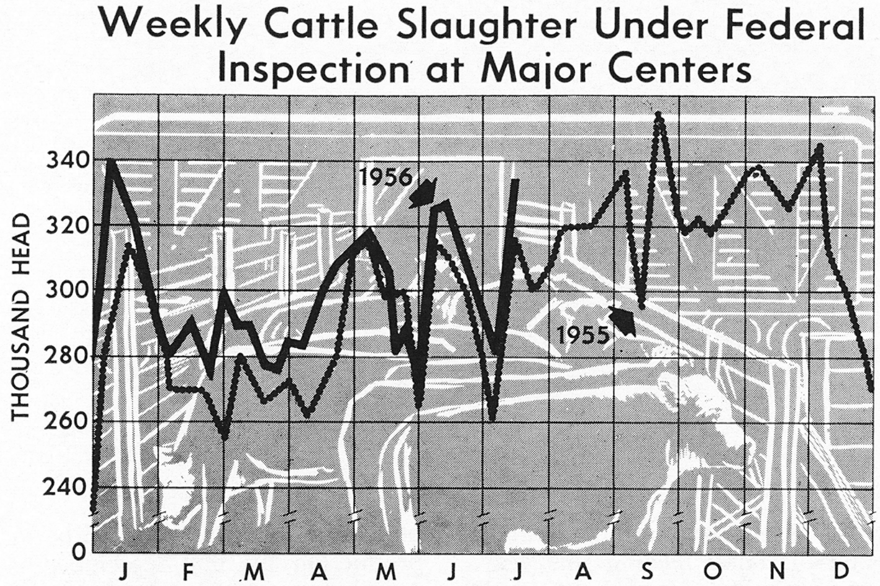
As a result, hog slaughter isn't expected to drop below the levels of a year earlier until late in the summer or in early fall. During the final months of 1956, it should be significantly below the output of late 1955.

The seasonal drop in hog prices this fall will be less than the sharp drop of a year ago. Hog prices are expected to be above those of a year earlier during the fall months—with the widest margin over those of a year ago at the year's end. During November and

December, hogs shoud be $3 to $4 higher than what they were during the period of extremely low prices last year.

On June 1 farmers were planning to cut their fall pig production by about 7 percent. Whether the cut will finally be this large depends mainly on the outcome of this year's corn crop.

However, the total fall crop almost certainly will be smaller than that of a year ago. So hog prices through the winter and spring months will be above the levels of those of last year.



Cattle . . .

About 4 percent more cattle were slaughtered in the first half of 1956 than in the same period of 1955. The increase wasn't uniform among all classes of livestock, however. There were more steers, slightly more heifers and fewer cows killed.

Total cattle slaughter in the second half is expected to equal or exceed the last half of 1955. But the total amount of beef produced may not be any more; for carcass weights will be considerably lighter. There will be more of the cattle killed in the second half of the year that come off grass than last year — fewer will come from feedlots.

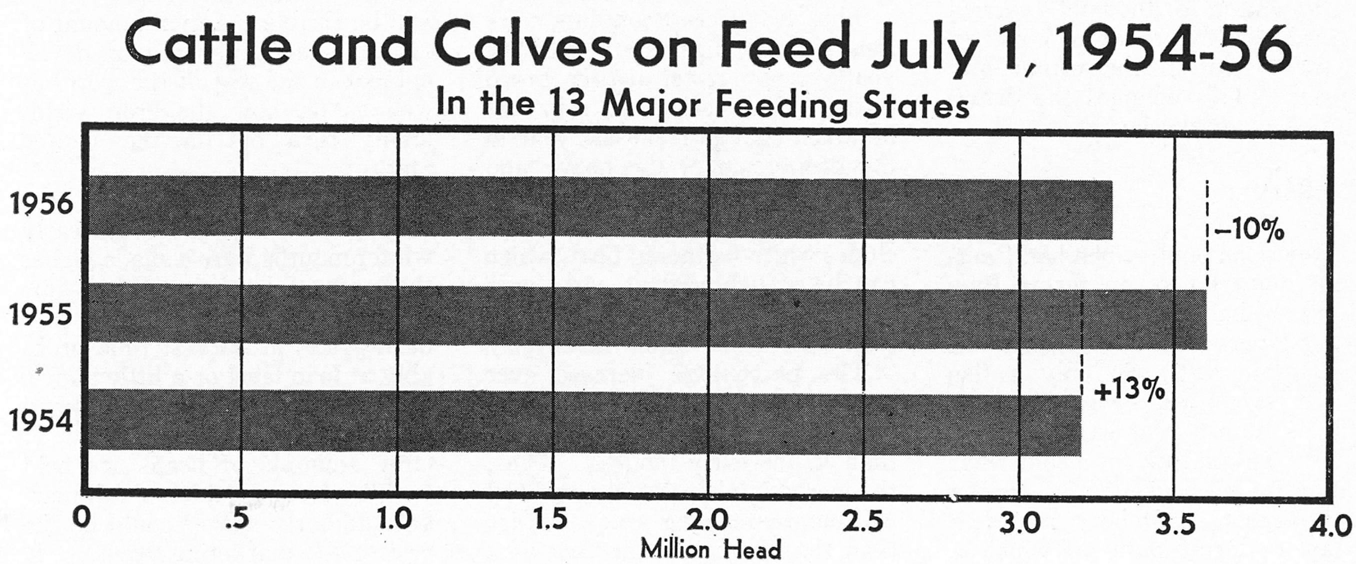
This points to wider price spreads between grades of cattle during the latter part of 1956 than we had a year ago. Prices for grass cattle will decline this fall. The amount of decline will depend mainly on how fast farmers fill their feedlots. Feeding profits were unsatisfactory last winter. But the higher prices for fed cattle during the latter part of July brought forth renewed interest in the feeding picture. If fed cattle prices stay above the levels of a year ago and crops over the Corn Belt turn out equal to midsummer prospects, the number of cattle on feed Jan. 1 isn't likely to be much different from that of a year earlier.

If this proves true, cattle feeding profits will be better on cattle sold during the first half of 1957 than on cattle sold in the latter part of the year. Profit prospects for the feeding year as a whole are moderately good. Feeder cattle in mid-July averaged about $2.50 lower than a year earlier. The difference was mostly on older steers.

As the new feeding season begins, there's another favorable point: The cattle feeding business is not plagued with the carryover of heavy steers as was the case last year. These heavier steers were a price-depressing force in the fed cattle market all fall and winter a year ago.

Lambs . . .

Seasonal declines in lamb prices are in prospect for the summer and fall as marketings off grass expand. Barring unusual drouth, lamb marketings the rest of the year will likely average closely to or slightly below those of a year earlier.



Profit prospects are moderately good for lamb feeding this year. Supplies will be less than a year ago. More ewe lambs are likely to be held back for breeding purposes.

The big question in the lamb-feeding outlook is whether profits will be best on the early- or late-fed crop. This depends mainly on whether wheat pastures develop. Normally, in years of good wheat pasture, the profits are better on early-fed lambs than on late-fed lambs.

The last couple of years haven't been good wheat pasture years. As a result the movement of lambs out of Corn Belt feedlots has been heavy in late fall and early winter. Then the mid- and late-winter market was good—the result of considerably lighter supplies of fed lambs on the market.

In years when wheat pastures are good, fewer lambs are fed in Corn Belt feedlots. The marketings aren't as heavy in late fall and early winter, for the lambs carried on wheat pasture don't come to market until in the winter and spring. This changes the distribution of marketings.

Poultry . . .

American poultrymen had 1 percent more layers on farms June 1, 1956, than a year earlier. More aged layers will be replaced this year than last. So only a few more layers will be on hand on Jan. 1 than a year earlier.

But we can look for a somewhat larger laying flock this fall than a year earlier. Hatchery output to May 1—latest date on which a pullet could be hatched and be in production by mid-September—was 7 percent more than in the same period last year. Also, the trend toward higher rate of lay in the fall months is expected to continue.

Thus, more eggs will be laid during the fall months than last year. But the increase isn't likely to be large enough to prevent a seasonal rise in egg prices. However, the seasonal rise this fall will be less than that of last year—when prices started from an unusually low level. And the fall price peak will come earlier than last year when it came in December.

Turkeys . . .

The 1956 turkey crop is a record smasher—probably 10 million over the 65.6 million we raised last year! The previous record turkey crop was set back in 1954 when we raised 67.7 million birds.

This year's crop contains more heavy-breed birds than did last year's crop; fewer lighter breed birds. However, there may not be much change from last year in the proportion of the heavy and light turkeys marketed. This year the heavy-breed classification includes white-feathered birds which can be slaughtered at early ages when their weights are competitive with other small turkeys.

The percentage increase over last year in turkey hatchings was greater in the late spring months than in the early months. Thus, the increase in marketings this fall will be greater over a year earlier than the figures for the year as a whole. There should be *plenty* of turkey on the market during the holiday season.

Soybeans . . .

This year's soybean crop is headed for another new record. The resulting record production of soybean oil will be large enough to fully offset the expected smaller output of cottonseed oil and lard during the coming year. Thus, supplies of food fats other than butter in the marketing year beginning Oct. 1, 1956, will be about as large as this past year's record quantity. The main difference is that carryover stocks of edible oils will be somewhat smaller.

Consumption of food fats per person isn't likely to show much change. But the population is increasing so the total amount consumed will be larger than in any other year. Present prospects indicate that foreign demand—though not as large as last year—will be sizable. Actual amount of export demand depends on development in the rest of the world as well as on how the crop yields finally turn out in the United States.

Soybean oil and oilmeal contract prices in July for the early winter months were a shade higher than a year earlier at the same time. This would indicate soybean prices at harvest time probably at loan level or a little above. The fall price pattern will depend on the movement at harvest. If large amounts of beans are held back by farmers, the late fall market and early winter could be the best of the marketing year.